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(54) HOT MELT COATING COMPOSITIONS

(71) We, CAPSEALS PACKAGING PRODUCTS LIMITED, a British Company of Little Green Works, Collyhurst Road, Manchester M10 7RX, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to hot melt coating compositions which may be used to coat substrates to provide protection for such substrate against an environment corrosive or deleterious to the substrate, in particular by rendering the substrate impervious to such environment, or alternatively, which may be used for forming an adhesive layer for bonding two laminae together in the formation of a laminate.

Many compositions are available for use as adhesives in the formation of laminates and for use in the formation of protective coatings. However, for such use it is often of great importance that an inexpensive composition should be used.

Thus, in the formation of laminated paper it is known to use a bituminous adhesive despite disadvantages because it is readily available and is inexpensive. Such bituminous material has the disadvantages that it is dark in colour and may therefore be visible through the paper, it has an unpleasant odour, and it becomes brittle and loses its adhesive properties at low temperatures.

One object of the present invention is to provide a composition which is satisfactory for use as an adhesive in the formation of laminates or for use in the formation of protective coatings and which is inexpensive to manufacture.

A further object of the present invention is to provide a use for the substance known as atactic or amorphous polypropylene which substance is formed as a by-product of the manufacture of isotactic polypropylene and which substance was hitherto normally discarded as a waste product.

According to one aspect of the present invention there is provided a hot melt coating composition comprising a mixture of atactic polypropylene of the kind defined hereinafter and an additive consisting of at least one waxy or resinous substance.

According to a second aspect of the invention there is provided a method of forming a coating on a substrate comprising applying to the substrate a coating composition as described in the preceding paragraph in the form of a hot melt.

According to a third aspect of the invention there is provided a method of forming a laminate from two laminae or webs comprising applying to a surface of at least one of the laminae or webs a composition as described above in the form of a hot melt and then bonding the laminae or webs together.

According to a fourth aspect of the invention there is provided a method of forming laminated paper comprising applying a layer of a coating composition as described above in the form of a hot melt to a first sheet of paper and applying a second sheet of paper to such layer.

Atactic polypropylene of the kind defined hereinafter has adhesive properties but is soft and has poor cohesive strength and is unsuitable for use either as an adhesive or as a protective coating. The addition of at least one waxy or resinous substance to the atactic polypropylene in accordance with the present invention gives rise to a coating composition which has a cohesive strength greater than that of the atactic polypropylene on its own. A coating composition having a desired cohesive strength can be obtained by suitable choice of the nature and proportion of the additive.

For use as a protective coating on a substrate the coating composition should have

sufficient cohesive strength to give a strong bond between the coating and the substrate and subsequent to adhesion of the coating to the substrate the coating should be capable of hardening to provide a hard non-tacky finish. Generally, the more additive in a coating composition according to the invention the harder and the less tacky will be the coating which can be formed.

Atactic polypropylene, formed as a by product in the manufacture of isotactic polypropylene, is normally extracted by means of high boiling point solvents. Such solvents may be, for example, cyclic hydrocarbons of boiling points in the range 170°C to 180°C, and the extract is normally treated to recover as much solvent as possible giving a substantially solvent-free solid product. A product is however also commercially available which is a waxy colourless to yellow substance containing from 2% to 15% by weight of residual solvent. Such residual solvent acts as a tackifier and the product is a sticky amorphous mass. It is this solvent-containing product with which the present invention is concerned, it having been found that the presence of the residual solvent contributes markedly to the adhesive properties of the hot melt compositions of the invention, and such product is referred to herein as atactic polypropylene of the kind defined. A typical example of such atactic polypropylene of the kind defined is that supplied by I.C.I. Limited which contains residual solvent being a saturated hydrocarbon predominantly C12 and free from aromatics and which has the following physical characteristics: a viscosity at 150°C of 1000 to 3000 centipoises, a penetration in 5 seconds of 40 to 70 mm and a ring and ball softening point of 90° to 110°C.

The additive may be any suitable substance, for example a hydrocarbon substance having a molecular weight of at least 500 such as paraffin wax, preferably paraffin wax having a melting point in the range 120° to 150°F, polyethylene, preferably polyethylene having a melting point in the range 219° to 226°F, hydrocarbon resins, preferably a hydrocarbon resin having a softening point of 212°F, an ethylene/vinyl acetate copolymer, or a mixture of any two or more of these hydrocarbon substances.

By hydrocarbon resin is meant a solid or semi-solid mixture of aliphatic polymers including straight chain and/or cyclic structures but excluding aromatic structures, obtained for example from petroleum or wood.

For use as an adhesive it is preferred that in a coating composition according to the invention the atactic polypropylene of the kind defined forms the major constituent by weight.

Eaxmples of coating compositions according to the invention will now be described.

In the following examples it is to be understood that wherever reference is made to the use of atactic polypropylene, atactic polypropylene which contains 2% to 15% by weight of residual solvent, as hereinbefore defined is used.

Example 1

A coating composition comprises a mixture of atactic polypropylene and a paraffin wax having a softening point in the range 120° to 150°F, the wax forming 5% to 20% of the weight of the material.

A typical composition is:

90% by weight Atactic polypropylene
10% by weight Paraffin wax having a softening point in the range 135° to 140°F.

This coating composition is particularly useful for bonding webs of kraft paper in the formation of a laminate and has been found to give a fibre tear bond for such paper. It has been found that the strength of the bond is of the order of 250 gms/inch.

Example 2

A coating composition comprises a mixture of the following constituents:

Atactic polypropylene forming 50% to 80% by weight of the material
Paraffin wax, having a softening point in the range 120° to 150°F, forming 0 to 10% by weight of the material
Hard hydrocarbon resin forming 10 to 40% by weight of the material.
Low molecular weight polyethylene forming 5% to 10% by weight of the material.

A typical composition is:

50% by weight of Atactic polypropylene
10% by weight of polyethylene having a molecular weight of approximately 2000 and a melting point in the range 219°F to 226°F, for example the material ACP6 supplied by the Allied Chemical Corporation.
40% by weight of hydrocarbon resin having a molecular weight of 1400 and a softening point of 212°F, for example the resin Escorez (Registered Trade Mark) 1102B supplied by the Esso Petroleum Company.

This coating composition gives bond strength of the order of 600 gms/inch and is particularly useful for bonding reinforcing yarns to paper, the high bond strength facilitating reinforcement of the paper by the yarn.

Example 3

A coating composition comprises a mixture of the following constituents:

10% by weight of paraffin wax
20% by weight of hydrocarbon resin
70% by weight of Atactic polypropylene

This composition has properties intermediate the properties of the coating compositions described in Examples 1 and 2.

Example 4

A coating composition comprises a mixture of the following constituents:

Atactic polypropylene in the range 60 to 90% by weight of the material

High molecular weight, low density polyethylene in the range 10% to 40% by weight of the material

A typical composition is:

15% by weight of polyethylene having a Melt Index of 4

85% by weight of Atactic polypropylene

This composition has good bond strength and also has moisture vapour barrier properties.

Example 5

A coating composition for use in the formation of a protective coating comprises the following constituents:

Paraffin wax, atactic polypropylene, hydrocarbon resin, ethylene/vinyl acetate copolymer and polyethylene.

A typical composition is:

	% by weight
Paraffin wax having a melting point in the range 135° to 140°F	40
Atactic polypropylene	25
Cyclic hydrocarbon resin	15
Ethylene/vinyl acetate copolymer	5
Reclaimed polythene	15

This coating composition gives a hard, non-tacky protective coating when applied to a substrate.

The present invention may be applied to the formation of a coating on any suitable substrate, although preferably the invention is applied to the formation of coating on a web structure, for example, metal foil, a fabric web, or a paper web.

The application of the invention to the formation of laminates is particularly suitable for the formation of laminated paper.

In accordance with the present invention laminated paper may be formed by applying to one sheet of paper, by means of conventional curtain coating or roller coating apparatus, a layer of the coating composition, in the form of a hot melt, and applying a second sheet of paper to the layer whilst still hot. Such laminated paper does not have the disadvantages demonstrated by laminated paper formed from a bituminous compound.

Hot molten polyethylene by itself has a high viscosity, and it is normally necessary to employ expensive extrusion apparatus for applying polyethylene to a web structure. A particular advantage of the present invention is that a coating composition containing polyethylene can be readily applied to a web structure by, for example, curtain coating or roller coating apparatus, since a coating composition according to the invention comprising atactic polypropylene and polyethylene has a viscosity substantially less than that of hot molten polyethylene by itself.

WHAT WE CLAIM IS:—

1. A hot melt coating composition comprising a mixture of atactic polypropylene of the kind defined and an additive consisting of at least one waxy or resinous substance.

2. A coating composition according to claim 1 wherein the atactic polypropylene forms the major constituent by weight.

3. A coating composition according to claim 1 or claim 2 wherein the or each waxy or resinous substance is a hydrocarbon substance having a molecular weight of at least 500.

4. A coating composition according to claim 3 wherein the additive comprises paraffin wax.

5. A coating composition according to claim 4 wherein the paraffin wax has a melting point in the range 120° to 150°F.

6. A coating composition according to any one of claims 3 to 5 wherein the additive comprises polyethylene.

7. A coating composition according to claim 6 wherein the polyethylene has a melting point in the range 219° to 226°F.

8. A coating composition according to any one of claims 3 to 7 wherein the additive comprises hydrocarbon resin as hereinbefore defined.

9. A coating composition according to claim 8 wherein the hydrocarbon resin has a softening point of 212°F.

10. A coating composition according to any one of claims 3 to 9 wherein the additive comprises ethylene/vinyl acetate co-polymer.

11. A coating composition according to claim 5 wherein the wax forms 5% to 20% of the weight of the material and the atactic polypropylene forms substantially all of the remainder.

12. A coating composition according to claim 11 wherein the wax has a softening point in the range 135° to 140°F and forms 10% by weight of the material.

13. A coating composition according to claim 8 when dependent on claims 5 and 6 wherein the atactic polypropylene forms 50% to 80% by weight of the composition, the paraffin wax forms 0 to 10% by weight of the composition, the hydrocarbon resin forms 10% to 40% of the composition and the polyethylene forms 5% to 10% by weight of the composition.

14. A coating composition according to claim 13 wherein the atactic polypropylene forms 50% by weight of the composition, the polyethylene has a melting point in the range 219° to 226°F and forms 10% of the composition and the hydrocarbon resin has a softening point of 212°F and forms 40% by weight of the composition.

15. A coating composition according to claims 8 or 9 when dependent on claim 4 or claim 5 wherein the atactic polypropylene forms 70% by weight of the composition, the paraffin wax forms 10% by weight of the composition and the hydrocarbon resin forms 20% by weight of the composition.

16. A coating composition according to claim 6 or claim 7 wherein the polyethylene forms 10% to 40% of the composition and the atactic polypropylene forms substantially all of the remainder.

17. A coating composition according to claim 16 wherein the polyethylene has a melt index of 4 and forms 15% by weight of the composition.

18. A coating composition according to claim 10 when dependent on claims 8 or 9, 6 or 7 and 4 or 5 wherein the atactic polypropylene comprises 25% by weight of the composition, the paraffin wax comprises 40% by weight of the composition, the hydrocarbon resin comprises 15% by weight of the composition, the copolymer comprises 5% by weight of the composition and the polyethylene comprises 15% by weight of the composition.

19. A method of forming a coating on a substrate comprising applying to the substrate a coating composition according to any one of claims 1 to 18 in the form of a hot melt.

20. A method of forming a laminate from two laminae or webs comprising applying to a surface of at least one of the laminae or webs a composition according to any one of claims 1 to 18 in the form of a hot melt and then bonding the laminae or webs together.

21. A method of forming laminated paper comprising applying a layer of a coating composition according to any one of claims 1 to 18 in the form of a hot melt to a first sheet of paper and applying a second sheet of paper to such layer.

22. A coated element as formed by the method of claim 19.

23. A laminate as formed by the method of claim 20.

24. Laminated paper as formed by the method of claim 21.

25. A coating composition substantially as described with reference to any one of the examples.

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